Supplemental material

Could the Health Decline of Prehistoric California Indians be Related to Exposure to Polycyclic Aromatic Hydrocarbons (PAHs) from Natural Bitumen?

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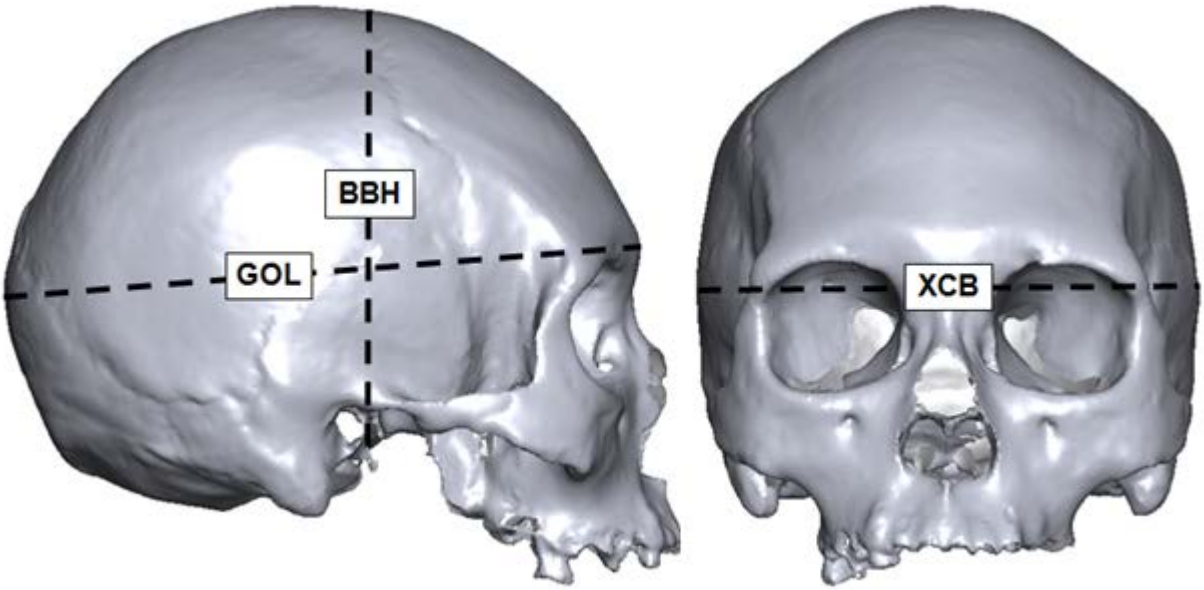
Contents

Compound	Sample I	Sample II	Sample III	Sample IV	Solubility[a]	Clean Water Act[b]
Fluorene	<0.1	0.1	<0.1	15.3	1980	x
2-Methylfluorene	<0.1	0.9	<0.1	<0.1		
Dibenzothiophene	0.2	4.9	0.5	<0.1		
Phenanthrene	24.6	10.4	13.4	893.7	1290	x
Anthracene	0.3	0.3	<0.1	<0.1	73	x
3-Methylphenanthrene	4.6	2.3	2.8	140.6		
2-Methylphenanthrene	32.9	15.0	17.6	832.2		
2-Methylanthracene	<0.1	<0.1	<0.1	1.0	39	
9-Methylphenanthrene	8.7	2.5	5.1	135.0		
1-Methylphenanthrene	7.5	1.8	3.0	79.9	269	
9-Methylanthracene	<0.1	<0.1	<0.1	<0.1	261	
2-Phenylnaphthalene	0.8	1.1	<0.1	29.1		
3,6-Dimethylphenanthrene	1.1	<0.1	<0.1	<0.1		
3,9-Dimethylphenanthrene	12.4	4.4	7.3	189.7		
Fluoranthene	0.6	0.1	0.3	12.0	260	x
Pyrene	0.7	0.3	0.9	18.8	135	x
9,10-Dimethylanthracene	<0.1	<0.1	<0.1	<0.1	56	
1-Methylfluoranthene	<0.1	<0.1	<0.1	<0.1		
Benz(a)fluorine	<0.1	<0.1	<0.1	22.3	45	
Retene	6.1	1.9	5.3	113.1		
Benz(b)fluorine	0.6	<0.1	<0.1	3.9	2	
2-Methylpyrene	<0.1	<0.1	<0.1	<0.1		
4-Methylpyrene	0.9	<0.1	<0.1	19.7		
1-Methylpyrene	0.4	<0.1	<0.1	15.0		
Benzo(ghi)fluoranthene	<0.1	<0.1	<0.1	<0.1		
Benzo(c)phenanthrene	<0.1	<0.1	<0.1	<0.1		
Benzo(b)naphto(1,2-d)thiophene	<0.1	<0.1	<0.1	9.8		
Cyclopenta(cd)pyrene	<0.1	<0.1	<0.1	<0.1		
Benzo(a)anthracene	1.2	<0.1	0.7	<0.1	14	x
Chrysene	1.1	<0.1	<0.1	<0.1	2	x
3-Methylchrysene	1.2	<0.1	<0.1	<0.1		
2-Methylchrysene	<0.1	<0.1	<0.1	<0.1		
6-Methylchrysene	<0.1	<0.1	<0.1	<0.1		
1-Methylchrysene	<0.1	<0.1	<0.1	<0.1		
Benzo(b)fluoranthene	2.2	3.0	<0.1	<0.1		x
Benzo(k)fluoranthene	<0.1	1.1	<0.1	<0.1		
Benzo(e)pyrene	0.4	<0.1	<0.1	<0.1	5	
Benzo(a)pyrene	<0.1	<0.1	<0.1	<0.1	0.05	x
Perylene	<0.1	<0.1	<0.1	<0.1	0.4	
Indeno(1,2,3-cd)fluoranthene	<0.1	<0.1	<0.1	<0.1		
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1		x
Dibenz(a,h)anthracene	<0.1	<0.1	<0.1	<0.1		x
Benzo(ghi)perylene	<0.1	<0.1	<0.1	<0.1	0.3	x
Coronene	<0.1	<0.1	<0.1	<0.1	0.1	
Sum PAH ng/mg	108.6	50.1	57.0	2531.3		

[a]Solubility in water (µg/liter), values taken from reference (Lee et al. 1981).
[b]Identified on the US EPA 2009 priority pollutant list, according to the Clean Water Act (USEPA 2009).

Supplemental Material, Table 1. Concentrations [ng/mg] of polycyclic aromatic hydrocarbons (PAHs) in samples of raw bitumen (I=Simonton Cove, II=East Cuyler, III=Crook Point, IV= La Brea Tar Pits, Los Angeles).



Supplemental Material, Figure 1. Cranial volumes were calculated from digital 3D models by multiplying three linear distances between standardized cranial landmarks, i.e., glabello-occipital length (GOL), basio-bregmatic height (BBH), and maximum cranial breadth (XCB). The landmarks involved have been described by Howells (1973). Olivier (1969) has shown that multiplication of these three linear distances yields a volumetric value that is proportional to the size of the cranial vault. It is in principle possible to obtain the volume of a 3D model as such (Sholts et al. 2010b), but only if the cranium is intact. Hence, the method of measuring three linear distances is better suited for archaeological crania which often display various kinds of damage.

References

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